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An overstepped segmented lagoon complex on the KZN continental shelf, South Africa

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Recently collected multibeam data from the Durban Bight, KwaZulu-Natal, reveal a drowned calcarenite barrier complex, stranded by sea level rise during transgression. Three theoretical responses of barrier systems to sea level rise exist: 1) erosion of the drowning coastline via wave erosion; 2) translation whereby coastal landforms are shifted landward and up depositional profile; and 3) rollover where the entire coastline is overstepped and stranded. Here we present an extremely rare example of an overstepped series of coastal barriers preserved in the mid shelf. Our objectives are to: 1) provide detailed observations of the seafloor and subsurface geomorphology of the study area; 2) provide a model for how such features may have formed in light of oceanographic and sea level constraints. A 20 km2 portion of seafloor was mapped using a 160 KHz WMB-160F multibeam echosounding system. Positions and attitude estimations were provided by a Furuno SC30 system. All data were corrected to depth relative to MSL after reconciliation with sound velocity profiles and tidal fluctuations. All data resolve to $\sim$ 5 m in the horizontal domain. Bathymetric data were complemented by $\sim$ 100 km of high resolution, single-channel Boomer data. We recognise several features that closely resemble features of contemporary segmented lagoon and lake systems. These are semi-circular seafloor depressions, arcuate ridges, cuspate spits and prograding submerged barriers. These overlie a series of compound incised valley networks, the fill of which comprises five distinct seismic facies. These are dominantly moderate to weak amplitude, onlapping reflector packages, interspersed with laterally continuous, high amplitude, sheet-like reflectors. Incised valley fills terminate in onlapping/downlapping facies within which isolated bodies of sigmoid moderate amplitude reflector configuration occur. An initial incised valley was formed following a sea level lowering to the Last Glacial Maximum $\sim$ 18 000 BP. Thereafter continued transgressive infilling, under relatively tranquil conditions occurred to a point where an extensive lagoon and back barrier system was established. At this point, sea levels remained static causing the net segmentation of the system and slow closure of the tidal basins. The incised valley fill itself lacks the capping shoreface deposits typical of such systems, the result of vigorous current stripping by the Agulhas Current. Such seafloor topography would be rarely preserved; the product of fortuitous cementation after deposition and the stripping of sediment that would ordinarily bury such features during sea level rise.